Community Observation Networks for Woodsmoke: Rangiora 2015 Pilot Study

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Use of solid fuel, mostly wood but also coal, particularly in some South Island towns, is a major source of night-time airborne pollution in many places in New Zealand (Coulson *et al* 1213). The problems of woodburning in NZ are similar to those in Alpine valleys across Europe and North America where woodsmoke collects, leading to high concentrations of particles in particular.

NIWA's Rangiora 2015 winter air quality field study was a pilot study for a concept called 'Community Observation Networks for Air' (CONA). The study included the first deployment in the field of NIWA's Outdoor Dust Information Nodes (ODIN) (Olivares *et al* 2014) as a smoke-monitoring network. We also trialled the online recruitment of local residents as participants to collect indoor data on wood-burning (using temperature sensors) and indoor air quality (using PACMAN) (Olivares et al 2012), as well as an online survey. Our secondary purpose was to improve our understanding of local emissions and dispersion and test whether these new approaches could successfully add new information.

Rangiora (population ≈12,000) was chosen to observe the phenomenon of "flow reversal" (changes in wind direction of > 90° during winter evenings). Analysis of historic records showed flow reversal to be the dominant airflow characteristic of Rangiora with a possible link to high PM_{10} levels, presenting a good test case for the abilities and value of the ODIN network.

Two existing meteorological sites (ECan in the town centre and NIWA EWS to the south east) were supplemented by three additional sites at the town's periphery for the duration of the campaign along with helikite-suspended radiosonde and ceilometer. The location of all instruments is shown in the figure below.

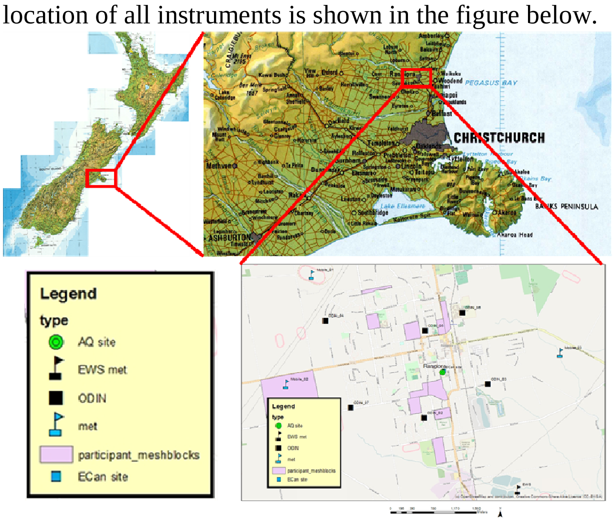

Figure 1. Location of PM and meteorology sites.

Results

Overall we found a strong association of flow reversal with high PM_{10} (doubling on average relative to non-reversed modes). Flow reversals followed a very consistent pattern, usually beginning between 17:30 and 18:00 and lasting 2 – 3 hours before opposing winds became fully re-established across the town. PM_{10} peaked ~90 minutes after a minimum in wind speed was observed. Secondary and quite variable PM_{10} peaks were observed on some nights after 9pm. Understanding the cause of the secondary peaks is limited by our small dataset but could be the subject of future CONA studies.

Community Engagement

The online process created for the recruitment of local participants was efficient and successful at the small scale at which it was deployed. The existence of the portal and study was advertised using local media, and limited local contacts, supported by the NIWA website. 17 people registered, considered sufficient for the pilot study. The ongoing level of participation was very high with sustained use of our daily survey and most participants agreeing to host instruments in their homes. The data collected though our participants was crucial and indicates the value of this approach.

Coulson, G., Wilton, E., Somervell, E., Longley, I.D. (2013) Proceedings of 16th IUAPPA World Clean Air Congress, Cape Town, October 2013

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Olivares, G, Longley, I, Coulson, G, 2012. Development of a low-cost device for observing indoor particle levels associated with source activities in the home. Healthy Buildings 2012, Brisbane, July 2012.

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